Economic Growth And Financial Indicators Connection

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Abstract

Real macro economic factors have always been accepted as main determinants of nations' economies'. However, the development of financial markets and the rise of financial activities in globalizing world economies have led financial actors to affect nations' economies' more and more everyday.

With the rise of liberalization process after 1980, the influences of financial developments rised in Turkey, too. In today's world, the effects of financial factors on Turkish economy is more evident than any time.

In this study, with the aim of detecting the effects of financial factors on Turkish economy, the relations between financial data as Exchange rates, interest rates and IMKB 100 index and economic growth has been analysed.

Keywords: financial data, exchange rates, interest rates, economic growth, Vector Auto Regression Model (V.A.R).

1.INTRODUCTION

The relation between financial developments and economic growth has been frequently debated subject lately. These debates mostly focus on the case that financial developments affect economic growth or economic growth affects financial developments.

In today's economies in which financial markets gradually enlarge and financial instruments gradually increase, it is observed that financial improvements influence economic growth. Assets' prices are formed and change under the influence of financial developments; financial developments determine consumption and investment expenses in a significant amount.

In this study, financial macroeconomic data and economic growth relation has been analysed by dividing the onservations between 1998-2010 into quarters. After a literature review of the subject, causality relation between financial data and economic growth has been analysed by granger causality test. After that, vector auto regression (VAR) model has been applied. Lastly, effect-reaction functions have been deducted by the help of correctness tests.

2. Empirical Studies

Harvey (1998) studied the relation between interest rates and maturity form and consumption expense. Estrella ve Hardouvelis (1991) analysed the one between bond yields and growth. Cozier ve Tkacz studied the amount of impact that interest rates in Canada have on GSYİH. Mishkin (1995) and Bernanke and Gertler (1995) asserted that the causality from interest rates to real production is dubious. Kamin and Rogers (2000) studied the relation between national income and exchange rate. Çetintaş and Barışık (2003) analysed the relation between banks, capital market and economic growth.

3. Data Set and Method

In today's Turkey which has adopted liberal politics, it has occurred as a subject of debate that the nation has left open to foreign shocks after the elimination of restraints beyond foreign capital. Besides, it is asserted that a nation having savings gap needs foreign capital for financing its expenses, mainly investment expenses and otherwise a crisis may occur.

With this aim, the years between 1998 and 2009 have been analysed in three-month segments and macro economic data has been analysed with capital movements towards Turkey. After detecting the crisis level that is caused by corruption of macro data, whether capital movements are influential on these corruptions or not and which macro economic data at which amount is influenced by capital movements have been searched for. Analyses eviews 5.0 packet programmes and VAR model were used for that.

Table. 3. 1 Macro Economic Variables Used in the Model

Variables	Code of Variable	Type	Definition
Growth Rate (GSYİH)	GROWTH1	Endogenous	Seasonal Adjusted Stagnant
Real Foreign Exchange Rate	EXCHANGELOG1	Endogenous	Seasonal Adjusted Stagnant
Foreign Exchange Interest	INTEREST1	Endogenous	No seasonal impact observed
Deposit Banks Loans	LOANSA1	Endogenous	Seasonal Adjusted Stagnant
IMKB 100 Index	IMKBLOG1SA	Endogenous	Seasonal Adjusted Stagnant

The series in the model have been selected as quarter periods from TCMB electronic data distribution (EVDS) and they include the periods between the first quarter of 1998(1998Q11) and the fourth quarter of 2009(2009Q4). All series that are subject to analyse have been composed of precise periodic values. Numerical values that the the series are composed of have been added to calculation as TL.

In the first step, it was analysed if the series contains unit root or not by the help of Augmented Dickey Fuller and Dickey Puntola tests. The unit roots ones are bowdlerized of root. After that, by rate to moving average method it was deseasonelized. In the third phase, optimal delay values for the model have been determined with information criteria. In the fourth step, relations between series and their directions were detected by Granger causality test. In the fifth phase, VAR (Vector Auto Regressive) model was formed for the forecast of

relations of foreign capital flow and reel macro economic data. In the sixth phase, relations between variables were analysed by establishing cause and effect functions.

4. Model Determination and Analyses

4.1. VAR (Vector Auto Regressive) Model

Description and analyses of engagements between macro economical variables, forecasting the future is significant. However, engagements are mostly mixed and multi dimensional. The direction of the relation between variables, detection of dependent and independent variables may be difficult. For this reason, simultaneous equation systems are required.

VAR Model (Vector Auto Regressive) is a model in which many variables are included in the analyses with their past values and each equation is settled out by the method of least-square method (Gujarati 2009:747). They have been developed for analyses of simultaneous equation system. In this type of models, there are no boundries of in-out division. This model puts all variables under operation at the same time and analyses in integrity. Variables can be used even if they are not stabile at the same level. It is a cause of choice in time series analyses for the reason that there are no restraints and it allows analyses of dynamic relations. The fact that delayed values of dependant variables are included in the model paves the way to strong anticipations of the future. With two variables, VAR Model can be formulated as this:

$$y_t = a_1 + \sum_{i=1}^{p} b_{1i} y_{t-1} + \sum_{i=1}^{p} b_{2i} x_{t-1} + v_{1t}$$

$$x_t = c_1 + \sum_{i=1}^{p} d_{1i} y_{t-1} + \sum_{i=1}^{p} d_{2i} x_{t-1} + v_{1t}$$

In the model, a1 is constant term, p is delay length, v is error term. In VAR model the average of error terms is zero. Kovarians with delayed values is zero. Variances are constant. They are in normal distribution and rassal quality. It is assumed that there is no relation between errors and their delayed values but this doesn't mean a restraint to the model. Otocorelation problem may be eliminated by increasing delay length of variables. However, in the condition of errors' being in relation to each other (the correlation between them is different from zero), change in one of the errors affects the other in a certain amount of time. There is no relation between error terms and variables on the right of the model. On the right handside of the model, there are delayed values of inner varibles and there isn't the problem of simultaneouty. This allows the equations in the model to be settled out with least squares method.

4.2. Stagnancy

Stagnancy is a variable's avarage, variance and otocovariance's being stable in time.

$-E(Y_t) = E(Y_t) = \mu$ ⟶ Average

$-Var(y_t) = E(y_t - \mu)^2 = \sigma^2$ ⟶ Variance

$-\gamma_k = E[y_t - \mu)(y_{t-k}) - \mu)]$ ⟶ Covariance

Serie's stagnancy is important in time series which follows a stocastic period. In stagnant series, possible shocks will be temporary. The impact of shock will decrease gradually and serie will be back to long term avarage level. In instagnant series, there will be no long term avarage that the serie can go back after the shock. Series' stagnancy is determined by unit root test. Expanded Dickey Fuller (ADF) tests are used for this.

$$\Delta X_t = a + \alpha X_{t-1} + \beta \sum_{i=1}^{m} \Delta X_{t-i} + e_t \quad (1)$$

$$\Delta X_t = a + bt + \alpha X_{t-1} + \beta \sum_{i=1}^{m} \Delta X_{t-i} + e_t \quad (2)$$

Equations numbered (1) and (2) are the regression equations which are used for Dickey Fuller test. Number (1) is an equation with a steadiness but without a trend, and number (2) is an equation with both a steadiness and a trend. In number (1) equation H0: α =0 hypothesis and in number (2) equation H0: b =0 hypothesis is tested for unit root test. If H0 is rejected, Xt serie is stagnant, if not rejected it is not stagnant. Acoording to the results of ADF unit root test, series are analysed to see if they have unit root on peg and this is done looking at %1, %5 and %10 significance levels. Once the unit root is found, difference is taken and evaluated out of the unit root (Bozkurt 2007:27–45).

Dickey Fuller Test was tested on %5 significance level with variables subjected to analysis. While the test was being carried out, it was tested automatically using Schwarz Info Criterion option since it was unknown if the error term was with autocorrelation. First differences of not-stationary ones were differed from the unit root by taking I(1).

Table. 5.2. Steady State of Variables

Code of variable	**Without trend**				**With trend**			
	τ	**%1**	**%5**	**%10**	**τ**	**%1**	**%5**	**%10**
Growth rate (GSYİH)	-5,78	-3,59	-2,93	-2,60	-5,48	-4,2	-3,53	-3,20
Real Foreign Exchange Rate	-7,85	-3,58	-2,93	-2,60	-7,77	-4,17	-3,51	-3,19
Foreign Exchange Interest	-4,59	-3,58	-2,93	-2,60	-4,54	-4,18	-3,52	-3,19
Deposit Banks Loans	-1,49	-3,61	-2,49	-2,60	-6,63	4,17	-3,51	-3,19
IMKB 100 Index	-5,07	-3,58	-2,93	-2,60	-5,03	-4,17	-3,51	-3,19
Number 1 in codes of variable shows that the first level difference of that serie is taken. * symbolizes level of the serie as %1 and ** as %5								

4.3. Delay Level for VAR Analysis

Delay lengths for VAR analysis were specified being dependent on LR, FPE, AIC, HQ, SC criteria in table 6.31 and via autocorrelation LM, heteroscedasticity White and normal distribution Jargue-Bera tests. The smallest delay level, where there is no autocorrelation (as

LM probability values more than 0,05), no heteroscedasticity (as White test Joint probability value more than 0,05) and there is normal distribution (as normality probability values more than 0,05), is 2 according to LR critical value.

Table. 5.3. Capital Movements and Delay Length for Real Data

VAR Lag Order Selection Criteria						
Endogenous variables: GROWTH1 EXCHANGELOG1 INTEREST1 LOANSA1 IMKBLOG1SA						
Exogenous variables: C						
Date: 05/23/12 Time: 22:58						
Sample: 1998Q1 2009Q4						
Included observations: 40						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	320.4919	NA	9.70e-14	-15.77460	-15.56349*	-15.69827
1	363.3976	72.93965*	4.01e-14*	-16.66988*	-15.40322	-16.21190*
2	383.6763	29.40417	5.40e-14	-16.43382	-14.11161	-15.59418
3	411.3330	33.18796	5.57e-14	-16.56665	-13.18889	-15.34536
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

4.4. Causation Analysis

While the relations between variables are studied, two things are aimed at: one is whether there is a connection between variables and if yes, in which direction; two is on which length of delay the connection might be taking place. Granger (1969) causation test is a test done for this purpose.

$$y_t = a_0 + \sum_{i=1}^{n} \beta_i x_{t-i} + \sum_{i=1}^{n} a_i y_{t-i} + u_i \quad (3)$$

$$x_t = \beta_0 + \sum_{i=1}^{n} a_i y_{t-i} + \sum_{i=1}^{n} \beta_i x_{t-i} + u_i \quad (4)$$

Through the causation test symbolised with the equations numbered (3) and (4), how the variables x and y affect each other is found. With the components of x added to the model, it gets clearer if x causes changes on the future values of variabley. The same is applied for y with a parallel reason.

It is necessary that the variables x and y are stagnant or to be made stagnant to conduct the Granger causation test. If the variables are not stagnant, a false causation will be observed. The causation which appears as a result of fake regression is a sign of simultaneous correlation.

Granger Causation Test was conducted for the reasons such as testing the correlation between capital movements and real data, and identifying which variables affected each other in what direction.

Table. 4.2. Economic Growth and Causation Test for Financial Indicators

Pairwise Granger Causality Tests			
Date: 05/23/12 Time: 23:00			
Sample: 1998Q1 2009Q4			
Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Probability
EXCHANGELOG1 does not Granger Cause GROWTH1	42	7.90027	0.00769
GROWTH1 does not Granger Cause EXCHANGELOG1		0.17014	0.68225
INTEREST1 does not Granger Cause GROWTH1	42	4.54812	0.03931
GROWTH1 does not Granger Cause INTEREST1		4.85088	0.03361
LOANSA1 does not Granger Cause GROWTH1	42	5.06493	0.03013
GROWTH1 does not Granger Cause LOANSA1		1.65679	0.20562
IMKBLOG1SA does not Granger Cause GROWTH1	42	12.5469	0.00105
GROWTH1 does not Granger Cause IMKBLOG1SA		0.49030	0.48795
INTEREST1 does not Granger Cause EXCHANGELOG1	46	8.32617	0.00609
EXCHANGELOG1 does not Granger Cause INTEREST1		6.53786	0.01417

LOANSA1 does not Granger Cause EXCHANGELOG1	46	0.25459	0.61644
EXCHANGELOG1 does not Granger Cause LOANSA1		5.22721	0.02722
IMKBLOG1SA does not Granger Cause EXCHANGELOG1	46	0.27700	0.60138
EXCHANGELOG1 does not Granger Cause IMKBLOG1SA		1.60341	0.21224
LOANSA1 does not Granger Cause INTEREST1	46	1.15539	0.28842
INTEREST1 does not Granger Cause LOANSA1		7.51754	0.00887
IMKBLOG1SA does not Granger Cause INTEREST1	46	0.43663	0.51228
INTEREST1 does not Granger Cause IMKBLOG1SA		0.09848	0.75518
IMKBLOG1SA does not Granger Cause LOANSA1	46	0.79231	0.37835
LOANSA1 does not Granger Cause IMKBLOG1SA		1.39905	0.24338

Portfolio investments, which constitute one part of capital movements, have a one-way influnce on the followings; other investments, export/import ratio and capacity utilization rate.

Other investments also have a one-way influence on economic growth. Furthermore, export/import ratio, capacity utilization rate, industrial production index and unemployment rate unilaterally affect other investments.

Foreign investments unilaterally affect industrial production index.

4.5. Rating of Variables

Rating the variables used in VAR method is applied for impulse-response functions which are used to specify the reactions of the variables to shocks. Rating should be from exogenous to endogenous. Assigning the correlation between exogenous and endogenous is done in connection with the reactions that variables give to temporary shocks. Whereas the most exogenous doesn't react against the shocks stemmimg from other variables, the most endogenous reacts against shocks both from others and the ones coming from itself. Rating the variables is mostly decided through Granger Causation Analysis (Çiçek 2005:82–105). In Cholesky decomposition, impulse-response functions may change when the variables are rated differently (Güloğlu 2010:3). A correct rating must take place if the aim is a successful analysis of the reactions of variables to shocks. In this study, variables are rated from exogenous to endogenous using Granger Causation Test.

Rating of real variables is as follows; direct investments, industrial production index, rate of capacity utilisation, growth, export/import ratio, unemployment rate ve other investments.

Rating of variables is as follows; real exchange rate, foreign currency interest rate, 100 IMKB indexes.

4.6. Impulse-Response Functions

Impulse-Response functions show how effective a standard deviation shock seen in one of the random error terms of VAR model findings might be both in the present and future values of endogenous variables. This decides whether the most effective variable could be used as a political tool or not. Cholesky decomposition is one of the common methods used in defining impulse-response coefficients, verticalising errors and diagonalising the acquired variance-covariance matrix.

Moving average method is one of the useful ways to analyse the mutual interactions between xt and yt series. ϕi coefficients are used to generalize the impacts of shocks in εxt and εyt on the series of xt and yt. Four elements of ϕjk (0) matris are influence values.

$$\begin{bmatrix} x_t \\ y_t \end{bmatrix} = \begin{bmatrix} \overline{x} \\ \overline{y} \end{bmatrix} + \sum_{i=0}^{\infty} \begin{bmatrix} \phi_{11}(i) & \phi_{12}(i) \\ \phi_{21}(i) & \phi_{22}(i) \end{bmatrix} \begin{bmatrix} \varepsilon_{xt-i} \\ \varepsilon_{yt-i} \end{bmatrix}$$

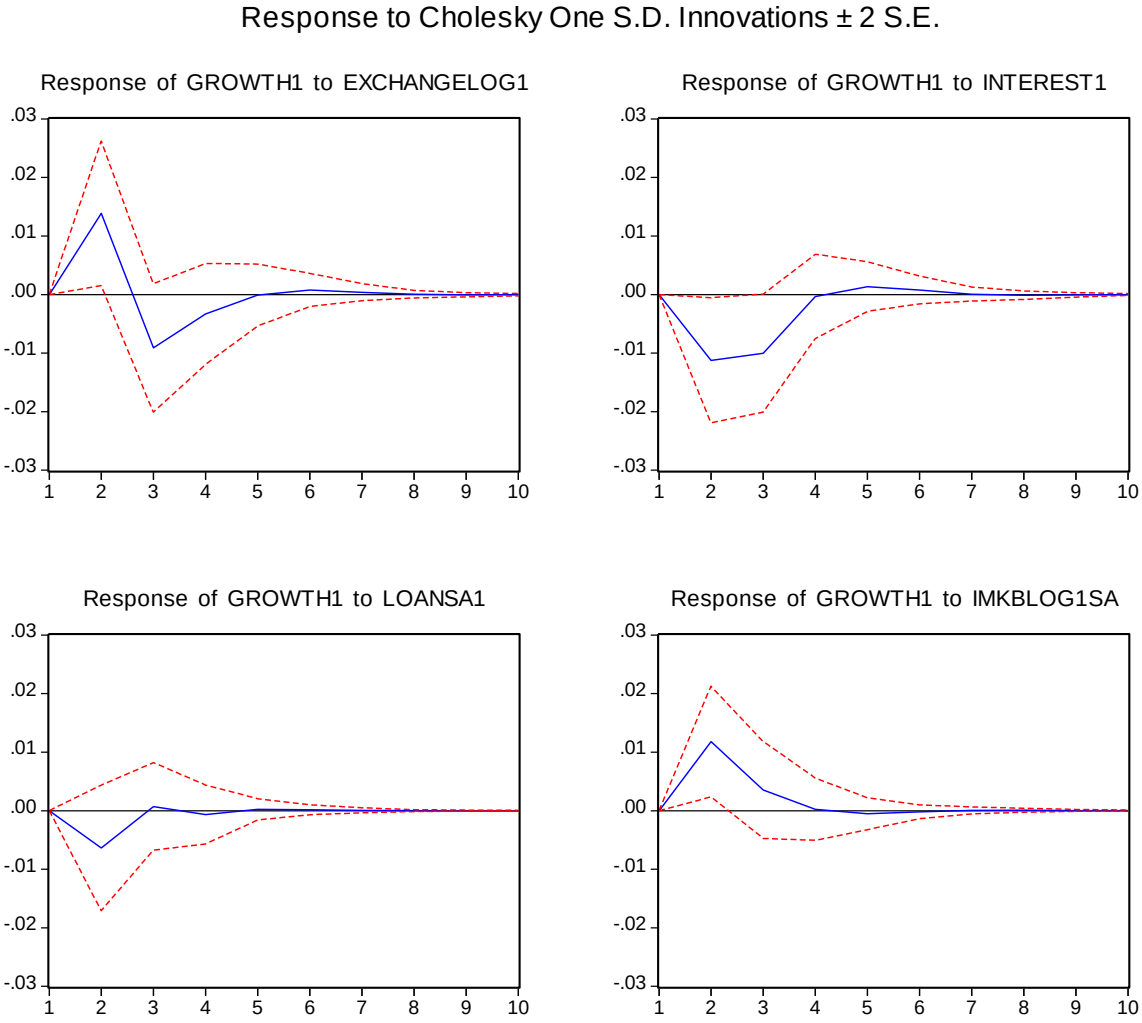
For instance, ϕ12 (0) shows the impact of a unit shock in εyt on xt serie. Again, it shows, respectively of ϕ11 (1) ve ϕ12 (1), the impact of a unit shock in εxt-1 ve εyt-1 on xt serie (Bozkurt 2007:94-98).

Cumulative actions of εxt and/or εyt term are acquired through impulse-response functions' sum of coefficients that their indexes match. For instance, it should be known that the item ϕ12 (n) is the result of the impact of εyt variation on xt+n after an n term. Therefore, the total of cumulative actions of the term εyt on xt serie after an n term is $\sum_{i=0}^{n} \phi_{12}(i)$. Long term influence value is acquired when n stretches into infinity. Since the series xt and yt are accepted static, the sum of $\sum_{i=0}^{n} \phi_{jk}^{2}(i)$ for all j ank k conditions is finite. Impulse-response function is the name given to ϕ11 (i), ϕ12 (i), ϕ21 (i) and ϕ22 (i) coefficients. (Bilgili vd. 2007:142-143).

Whether capital movements have an impact on financial data was analysed through causation test in previous part. In this section, on the other hand, disposability of capital movements as a political tool was tried to test using the impulse-response analysis.

Vector Moving Average (VMA) display format was used in order to show the possible reactions of real data to a standard deviation shock which may take place in capital movements through impulse-response analysis. Results were shown in figures 6.23, 6.24 and 6.25. In the graphics of impulse-response analysis, centerline shows point estimates and bottom and over lines show confidence interval of a standard error.

Figure 4.1. Impulse-Response Function



In figure 4.1, reaction shown by economic growth to a shock of standard deviation in real dutch disease, foreign currency interest and IMKB 100 indexes is shown. Reactions given could be outlined as follows;

Real dutch diseases positively affected the economic growth until the end of the second term. However, after the second term it couldn't put a recognizable impact.

Foreign currency interest rate negatively affected the economic growth until the third term.

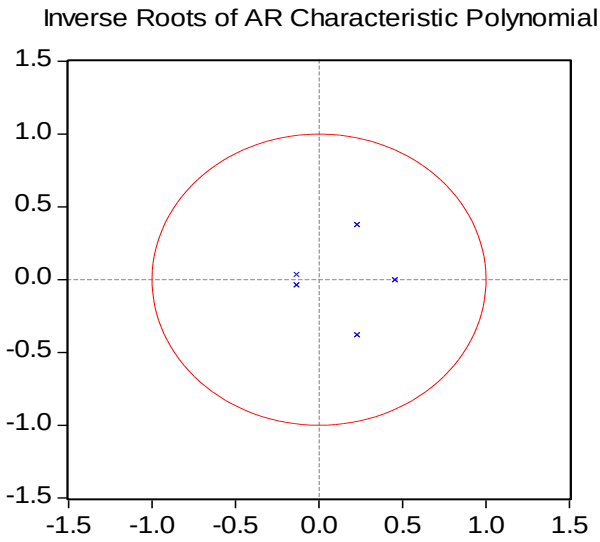
No significant connection between deposit bank loan and growth rate could be identified.

The impact of IMKB 100 index on economic growth was positive until the end of the second term. However, after the third term this influnce disappeared.

4.7. Stagnancy Test of VAR Model

Stagnancy should be tested after the model is set up. Stagnancy of the model depends on eigenvalues of coefficient matrix. System gets stagnant once all eigenvalues of coefficient matrix exist within unit circle. When the eigenvalues of coefficient matrix exist outside the unit circle, then the system is not stagnant. This means that it is because of the facts that since all the eigenvalues of coefficient matrix are in the circle unit that the model is stagnant.

Figure 4.2 Stagnancy Test for VAR Model



4.8. Autocorrelation Test of VAR Model

In order to testify whether VAR model involved a problem in structural meaning, Autocorrelation Test – LM was conducted. The test, which was applied to specify whether the error terms found in VAR model were connected, reveals that there is no autocorrelation for 12 lags.

Table. 4.3. Capital Movements and Autocorrelation-Lm Test for Real Data

VAR Residual Serial Correlation LM Tests		
H0: no serial correlation at lag order h		
Date: 05/23/12 Time: 23:03		
Sample: 1998Q1 2009Q4		
Included observations: 42		
Lags	LM-Stat	Prob
1	33.16078	0.1271
2	17.08283	0.8788

3	18.71859	0.8104
4	31.84992	0.1624
5	23.28707	0.5608
6	25.88333	0.4138
7	25.45298	0.4372
8	15.74284	0.9223
9	30.50397	0.2060
10	23.30021	0.5600
11	31.83537	0.1628
12	25.43800	0.4381
Probs from chi-square with 25 df.		

4.9. Heteroscedasticity Test

Chi-Square value shows there is no heteroscedasticity problem in the model predicted. In other words, it reveals the fact that error term variance is the same for all observations. It can be seen that there is no heteroscedasticity according to the results of white heteroscedasticity test.

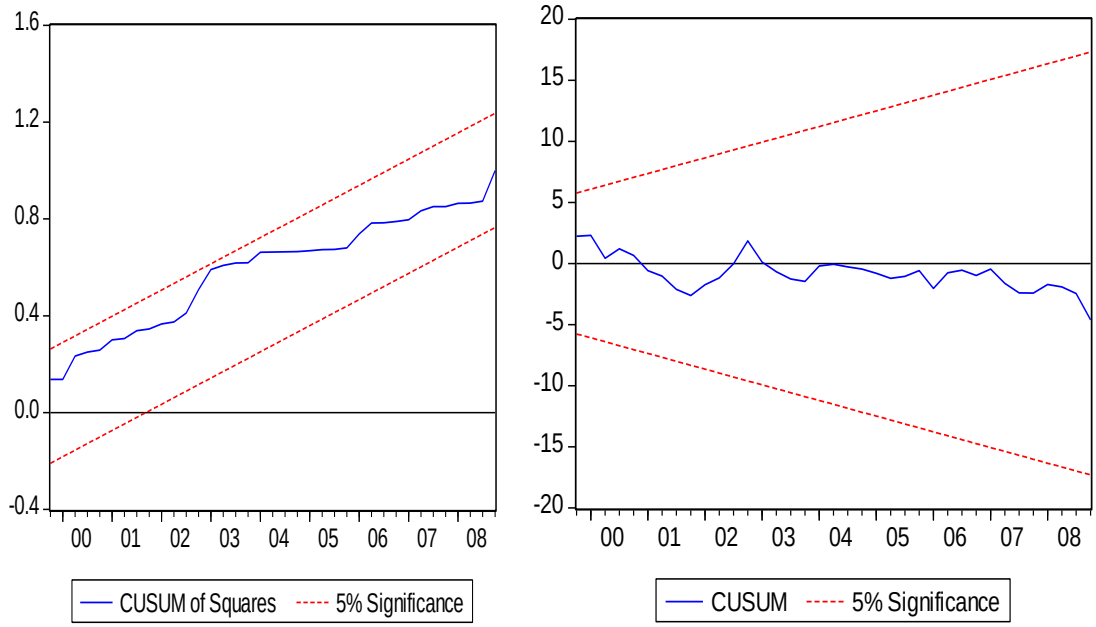
Table. 4.4. Capital Movements and White Test for Real Data

Joint test:		
Chi-sq	df	Prob.
160.3245	150	0.2672

4.10. Stability Tests

Conducting CUSUM and CUSUM squere tests, it was attempted to study whether there was a structural break in the model and no break was identified.

Figure 4.2 Stability Tests



5.CONCLUSION

Economical activities in modern-day economies are under the influence of both real and financial data. In this analysis, it is observed that interest rates, exchange rates and stock market data influence economic growth.

In a condition where bank loans are quite efficent in economical activities, changes in interest rates will influnce those activities. Real economical activities are really rapid in economies which are integrated into international system. Exchange rates, on the oher hand, have a decisive impact in this situation. Just as securities exchanges are affected by economic developments, economic life is also affected by the developments taking place in stock market.

Economies which plan to achieve a steady and constant growth should also realize healthy and sustainable finacial data besides their real macro economic data.

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